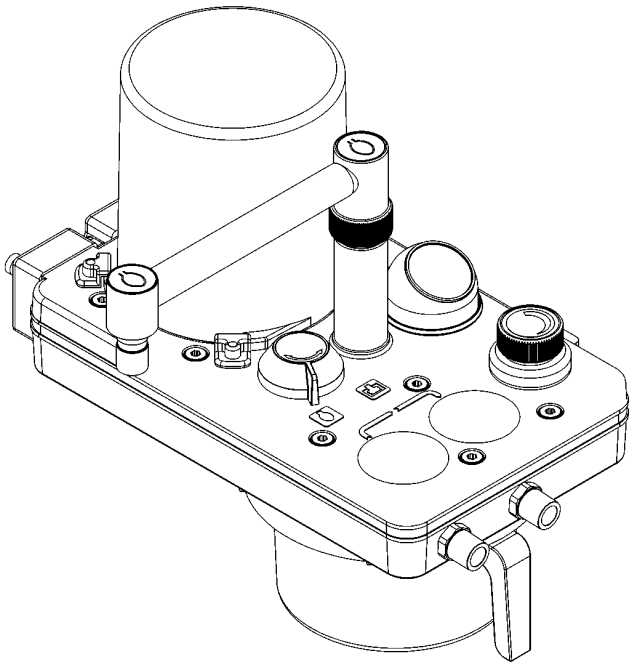
InterMed Penlon

A200SP Circle Absorber
Service Manual



Partnership for Life

IMPORTANT

Servicing and Repairs

In order to ensure the full operational life of this device, servicing by a Penlon-trained engineer should be undertaken periodically.

We recommend that the absorber should be serviced on the following schedule:

(a) Six monthly inspection and function testing.

(b) Annual service which includes routine replacement of seals etc, as preventive maintenance.

(c) Four-year service which includes additional component replacement.

Details of these operations are in this A200SP Circle Absorber service manual. Servicing should be carried out by Penlon trained engineers.

For any enquiry regarding the servicing or repair of this device, contact the nearest accredited Penlon agent:

or communicate directly with:

Technical Support Department
Penlon Limited
Abingdon
OX14 3PH
UK

Tel: 44 (0) 1235 547076
Fax: 44 (0) 1235 547062
E-mail: technicalsupport@penlon.co.uk

Always give as much of the following information as possible:

1. Type of equipment
2. Product name
3. Serial number
4. Approximate date of purchase
5. Apparent fault

FOREWORD

This manual has been produced to provide authorised personnel with information on the function, routine, performance, servicing and maintenance checks applicable to the A200SP Absorber.

Information contained in this manual is correct at the date of publication. The policy of Penlon Limited is one of continued improvement to their products. Because of this policy Penlon Limited reserves the right to make any changes which may affect instructions in this manual, without giving prior notice.

Personnel must take themselves familiar with the contents of this manual and the machine function before using the apparatus.

IMPORTANCE OF PATIENT MONITORING

WARNING
Anaesthesia systems have the capability to deliver mixtures of gases and vapours to the patient which could cause injury or death unless controlled by a qualified anaesthetist.

There can be considerable variation in the effect of anaesthetic drugs on individual patients so that the setting and observation of control levels on the anaesthesia system does not in itself ensure total patient safety.
Anaesthesia system monitors and patient monitors are very desirable aids for the anaesthetist but are not true clinical monitors as the condition of the patient is also dependent on his respiration and the functioning of his cardio-vascular system.

IT IS ESSENTIAL THAT THESE ELEMENTS ARE MONITORED FREQUENTLY AND REGULARLY AND THAT ANY OBSERVATIONS ARE GIVEN PRECEDENCE OVER MACHINE CONTROL PARAMETERS IN JUDGING THE STATE OF A CLINICAL PROCEDURE.

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USER RESPONSIBILITY

This device has been built to conform with the specification and operating procedures stated in this manual and/or accompanying labels and notices when checked, assembled, operated, maintained and serviced in accordance with these instructions.

To ensure the safety of this device it must be checked and serviced to at least the minimum standards laid out in this manual. A defective, or suspected defective, product must not under any circumstances be used.

The user must accept responsibility for any malfunction which results from non-compliance with the servicing requirements detailed in this manual.

Additionally, the user must accept responsibility for any malfunction which may result from misuse of any kind, or non-compliance with other requirements detailed in this manual.

Worn, broken, distorted, contaminated or missing components must be replaced immediately. Should such a repair become necessary it is recommended that a request for service advice be made to the nearest Penlon Service Centre.

This device and any of its constituent parts must be repaired only in accordance with written instructions issued by Penlon Limited and must not be altered or modified in any way without the written approval of Penlon Limited.
The user of this equipment shall have the sole responsibility for any malfunction which results from improper use, maintenance, repair, damage or alteration by anyone other than Penlon or their appointed agents.

USA and Canadian Federal Law restricts the sale and use of this device to, or on the order or, a licensed practitioner.

Statements in this manual preceded by the following words are of special significance:-

WARNING	***means there is a possibility of injury to yourself or others.***
CAUTION	*means there is a possibility of damage to the apparatus or other property*
NOTE	*indicates points of particular interest for more efficient and convenient operation.*

The reader must take particular notice of the warnings, cautions and notes provided throughout this manual

1. WARNINGS AND CAUTIONS

The following ***WARNINGS*** and ***CAUTIONS*** must be read and understood before servicing or repairing this Anaesthetic Apparatus

WARNINGS

General Information

1. ***Personnel must make themselves familiar with the contents of this manual and the function of the A200SP Absorber before servicing or use.***

2. ***Trichloroethylene must not be used in association with soda lime.***

3. ***This unit is restricted to use with non-flammable anaesthetic agents only.***

4. ***The A200SP Circle System Absorber must only be used when securely mounted in an upright position.***
   a) ***The inspiratory and expiratory non-return valves (NRV) are gravity operated.***
   b) ***Spillage of absorbent may contaminate the breathing system. See 3.2/5.1***

Before using the absorber

5. ***The use of patient Y-pieces containing non-return valves in connection with the Absorber is hazardous, because two sets of non-return valves may easily be connected in opposition, by error.***

6. ***Breathing hoses and bags used with the absorber must comply to ISO 5367 (Hoses) and ISO5362 (Breathing Bags) respectively. The resistance and compliance of these hoses and bags provide essential factors for the satisfactory use of this system.***

7. ***Do not connect a vacuum systems must not directly to the APL valve. A receiving system with positive and negative pressure control functions must be interposed. Systems must comply with ISO 8835 Part 2. See 5.2.3.***

8. ***Underfilling of the canister can lead to inefficient CO_2 absorption.***
   Overfilling may result in poor sealing of canister due to caking of granules and abrasion of the canister and seal.
   See 3.1 and 5.3.

9. ***Do not use the Absorber without ensuring that it passes all pre-use checks. See Section 6.***

10. ***After servicing and cleaning procedures, verify positive action of the bag/ventilator selector switch before the unit is used clinically.***

    Check that at all times that the switch is free to move from one end of its travel to the other.

Using the absorber

11. ***Condensation, which may collect in the bottom of the absorber canister is caustic and care must be taken not to spill it on the skin when draining.***

    See section 7.3.

13. ***Kinking of the fresh gas tube is a known cause of anaesthetic accident and the use of unsuitable tubing can contribute to this situation. See 3.5.***

14. ***Any breathing system utilising the A200SP absorber must be fitted with:***
    a) ***An oxygen monitor complying with ISO7767.***
    b) ***A minute volume monitor.***
    c) ***A breathing system integrity alarm.***

WARNINGS AND CAUTIONS

CAUTIONS

1. *Do not sterilise (autoclave) the manometer.*

2. *Do not autoclave the electrical interface unit at the rear of the absorber.*

3. *Remove the absorbent canister before autoclaving.*

3. *If the absorber has to be lifted or carried by hand, always support the weight of the unit under the base. Do not lift the absorber by gripping any of the components attached to the top of the absorber - the manometer, APL valve, breathing circuit connectors, etc.*

4. *Do not use any ventilator with the A200SP absorber that does not comply with ISO 8835 part 2.*

2. PURPOSE

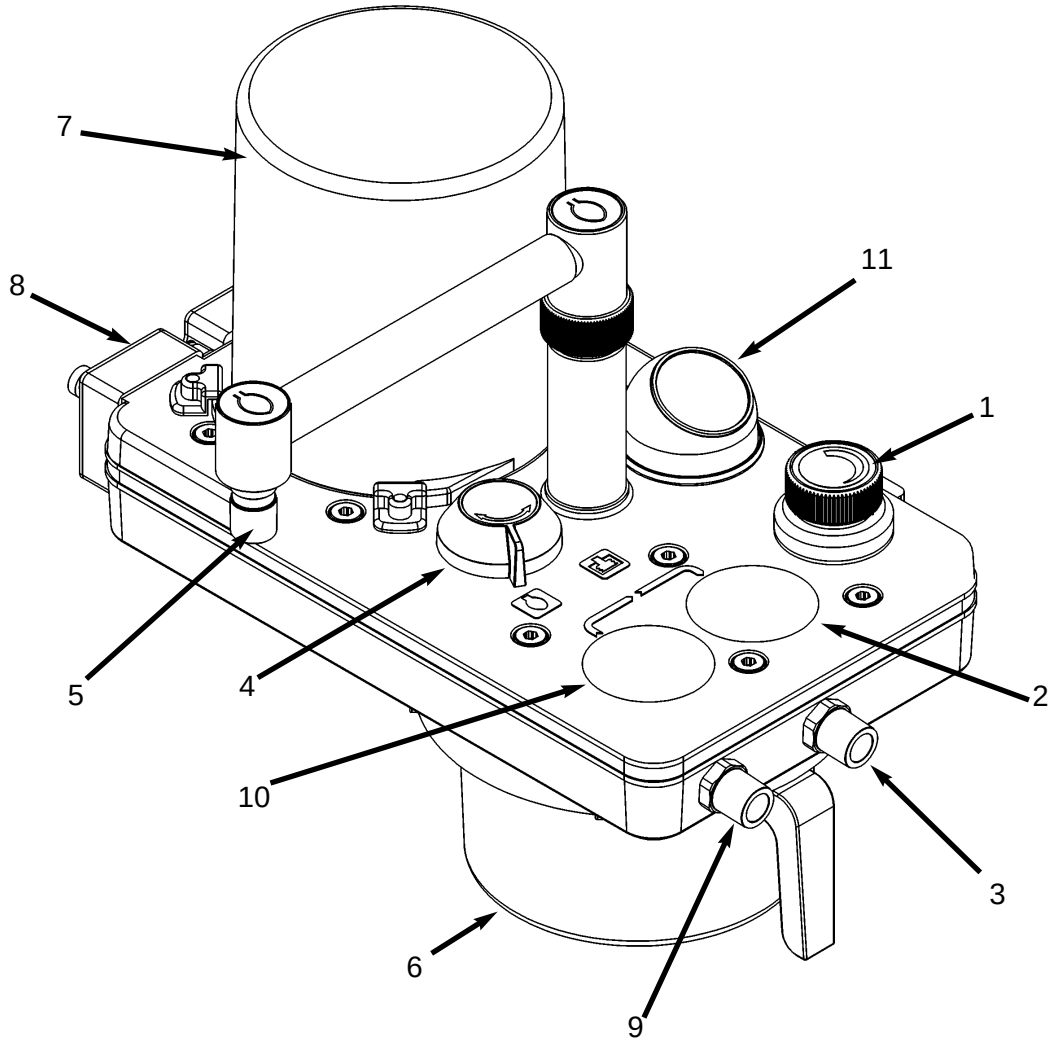
The A200SP Absorber is designed for use as part of a closed breathing system for anaesthesia, providing CO_2 absorption in conjunction with the appropriate ventilator, breathing hoses, reservoir bags and patient connections.

Depending on the flow of fresh gas relative to patient minute volume, the patient may receive fresh gas or partial recirculated gas, as determined by the anaesthetist.

The system incorporates a Bag/Ventilator switch to enable:

a) spontaneous breathing or manually assisted ventilation in ‘Bag’ mode.

b) use with an anaesthesia ventilator when ‘Ventilator’ is selected.



A200SP Circle System Absorber

1. Adjustable pressure limiting valve (APL valve)
2. Inspiratory non-return valve (NRV)
3. Inspiratory hose connector
4. Bag/ventilator switch
5. Reservoir bag connector
6. Canister
7. Ventilator bellows housing
8. Electrical interface unit
9. Expiratory hose connector
10. Expiratory non-return valve (NRV)
11. Manometer

3. DESCRIPTION

3.1 Canister

The canister (1) is designed to hold 1.3 kg of loose absorbent, or to take a prepacked unit.

The maximum fill level is marked on the canister and is equivalent to 1500 ml of absorbent.

DO NOT EXCEED MAXIMUM FILL LEVEL

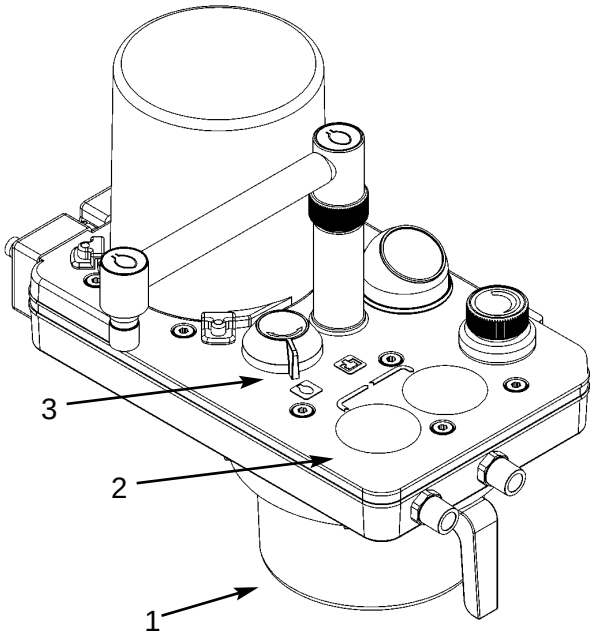
Fill to a level within 12 mm (0.5 in) of this line.

In addition, the absorber must only be used when securely mounted in an upright position – spillage of absorbent may contaminate the breathing system – see WARNING, in section 5.1.

The canisters seals at the top face.
The canister can be removed and refilled during a clinical procedure.

The gas flow through the canister is from bottom to top.

Note that the bag/ventilator connection is between the absorber and the patient. Bag squeezing or the use of mechanical ventilation does not result in the transport of dust toward the patient, but tends to drive dust back into the absorber.



3.2 Inspiratory and Expiratory Non-return Valves (NRV)

The valves are positioned on the top of the manifold block and control the direction of the gas flow through the system.

Each valve consists of a rubber disc located over a valve seat. The discs operate by gravity and are retained by guides to prevent lateral movement.

The valves are visible through the top cover (2) and the operation of each valve can be visually checked as the patient breathes in and out.

IT IS IMPORTANT THAT THE ABSORBER IS MOUNTED UPRIGHT SO THAT THESE VALVES MOVE IN A TRULY VERTICAL PLANE, WITH THE VALVE SEATS HORIZONTAL.

3.3 Bag/Ventilator Switch (3)

Ventilator mode
In 'Ventilator' mode the reservoir bag is closed off from the breathing system and the ventilator connection port at the rear of the manifold block, is in circuit.

WARNING The APL valve is out of circuit when the system is in 'Ventilator' mode. The ventilator must be equipped with a pressure relief valve.

Bag mode
The breathing bag acts as an additional over-pressure protection device, preventing pressure exceeding 60 cmH_2O.

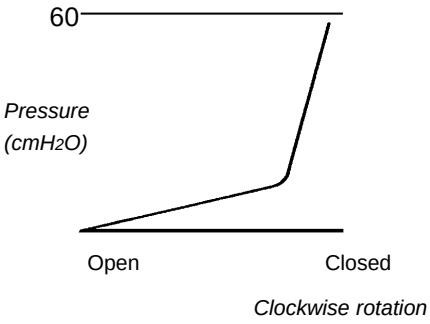
WARNING
If no ventilator is connected to the absorber, care must be taken to ensure that the bag/ ventilator switch is kept in the 'Bag' position, to avoid gross loss of gas from the breathing system and to maintain the reservoir bag in the system.

DESCRIPTION

3.4 Adjustable Pressure Limiting (APL) Valve

The APL valve is a spring loaded stainless steel disc valve, providing breathing system pressure control, and excess pressure relief.

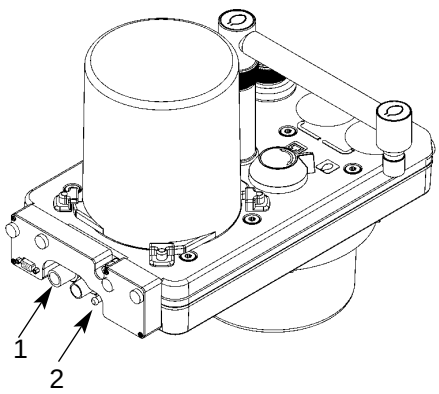
The spring pressure can be varied by rotating the control knob on top of the valve. In the fully counterclockwise position the minimum pressure is 1.0 cmH_2O at 6 L/min. This can be increased by clockwise rotation to 60 cmH_2O.



As shown in the graph above, further clockwise rotation causes a rapid increase in opening pressure so that in the fully closed position, the valve functions as a 60 cmH_2O excess pressure relief valve.

AGSS connector

Taper connector (1) at rear of absorber assembly.



3.5 Fresh Gas Inlet and Tubing

The fresh gas inlet (2) is at the rear of the absorber.

The absorber is supplied with a fresh gas hose assembly with attached end fitting. Do not use any other type of hose

WARNING
Kinking of the fresh gas tube is a known cause of anaesthetic accident and the use of unsuitable tubing can contribute to this situation.

3.6 Manometer

NOTE: The use of a manometer is strongly recommended at all times.

The manometer is located on the top of the manifold block to the rear of the expiratory valve .

Manometer scale:	–10 to +100 cmH_2O
Manometer accuracy:	±5% (within range +10 to 80 cmH_2O)

CAUTION
Remove the manometer before autoclaving the absorber unit.

3.7 Bypass System

It is strongly recommended that a capnometer is used to prevent the risk of hypercapnia.

When the canister is removed, expiratory gas passes directly to the APL valve and bag, or ventilator, without passing through the absorbent.

This allows the canister to be refilled during a clinical procedure

3.8 End Tidal Carbon Dioxide Monitoring

The use of end tidal carbon dioxide monitoring is strongly recommended.

Connection of a suitable analyser must be made between the patient's airway and the patient connection Y-piece.

Detailed instructions are provided by the manufacturers of the analyser.

DESCRIPTION

3.9 Interface to AV-S Ventilator

The absorber is designed to interface with the AV-S Ventilator and the ventilator bellows unit (1) is built into the absorber..

The interface cable links the connector (2) on the ventilator control panel to the multifunction connector (3) on the interface unit at the rear of the absorber.

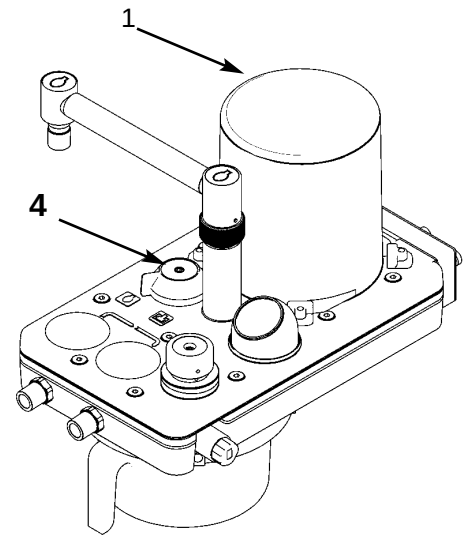
a) The A200SP is fitted with fitted with a sensor that detects the position of the absorber bag/vent control (4).
The sensor signal cabling is routed internally to connector (3)

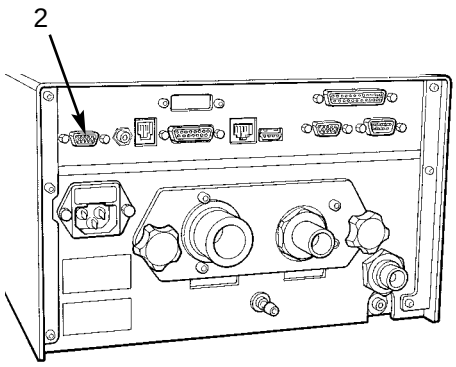
b) Operation of the Bag/Vent control will trigger automatic Mode switching on the AV-S ventilator, as follows:

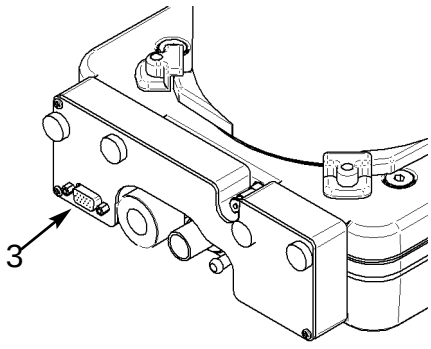
i) If the Absorber Bag/Vent control is moved from Vent to Bag, the ventilator will change from Volume Mode, or Pressure Mode, into Spontaneous Mode.

ii) Switching the absorber Bag/Vent control from Bag to Vent:
The ventilator will reset from Spontaneous Mode to the previously set active mode.

iii) If the ventilator is in any mode other than those detailed above, operation of the absorber Bag/Vent control will not affect the ventilator.
NOTE This function can be enabled/disabled through the AV-S on-screen menus (refer to the AV-S user manual).

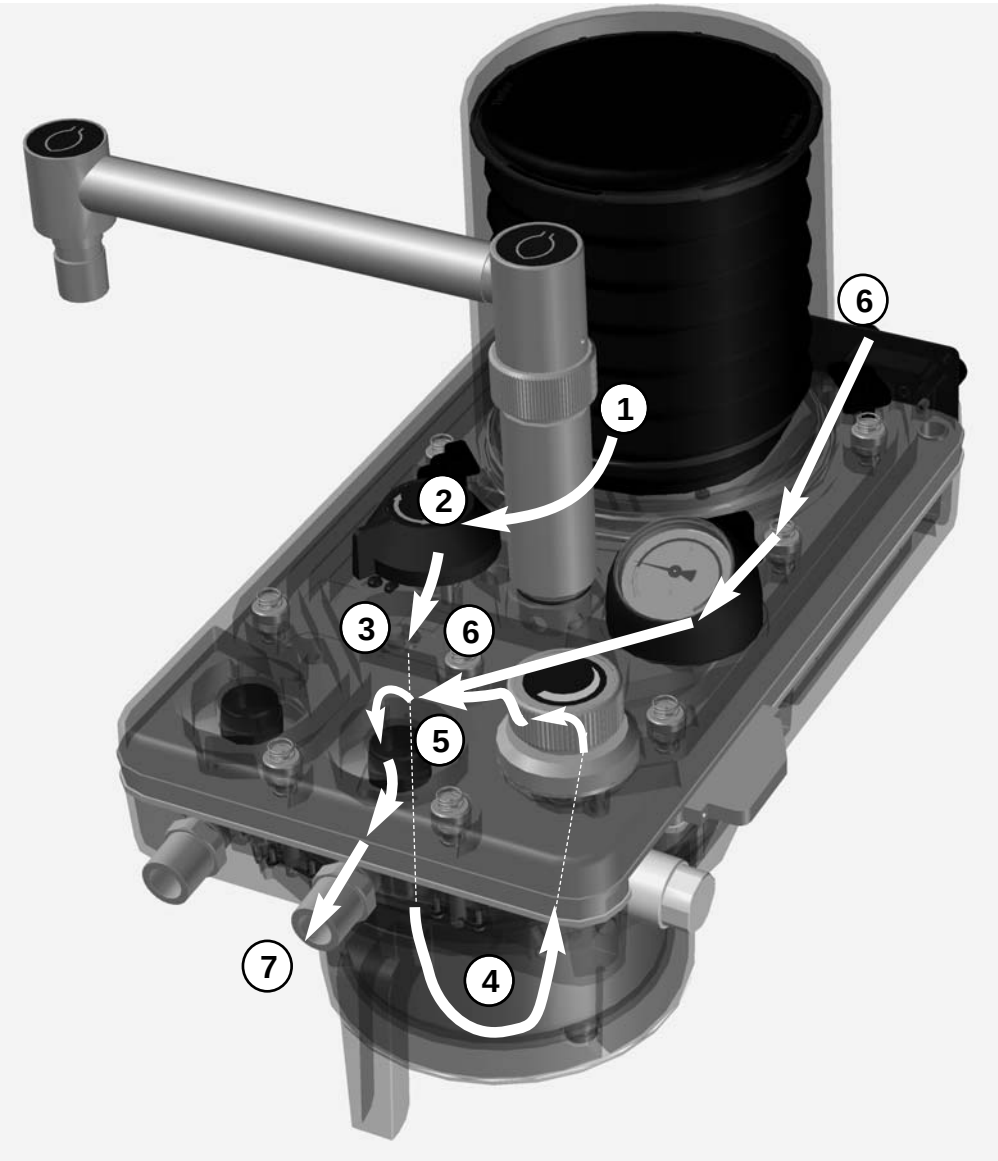






DESCRIPTION

3.10 Gas Flow Schematic



Inspiratory Gas Path

1. Patient Gas from bellows
2. Through the bag/vent switch
3. Down to absorbent canister
4. Through the absorbent
5. Into the inspiratory non-return valve
6. Fresh gas flow from anaesthetic machine
7. Through inspiratory connector to patient breathing circuit

4. SPECIFICATION

NOTE
Information in this section complies with the requirements of ISO 8835–2.

4.1 General Dimensions

All figures are approximate

Overall height	380 mm
Width	186 mm
Depth	240 mm
Weight (empty)	5.7 kg
Mounting system	Polemount assembly

4.2 Resistance of Breathing System

Resistances listed in 4.2.1 and 4.2.2 are measured with:

(A) An absorber fitted with 1060 mm (42 inch) breathing hoses complying with ISO 5367, and a Penlon Safelock Y-piece.

(B) Absorber only.

The canister must be filled to the MAX level with fresh absorbent, and theAPL valve fully open.

Bacterial Filter:

A bacterial filter must be used in the patient breathing system to protect the oxygen sensor.

Use an appropriate filter that does not raise the resistance values of the whole system to above 0.6 kPa (6 cmH_2O).

4.2.1 Expiratory Resistance

Tested with a flow of 6 L/min of air through the fresh gas inlet and an induced flow of 60 L/min through the breathing system.

(A) expiratory resistance: less than 0.6 kPa (6 cmH_2O)

(B) expiratory resistance: less than 0.5 kPa (5 cmH_2O)

4.2.2 Inspiratory Resistance

Tested with a flow of 6 L/min of air through the fresh gas inlet and an induced flow of 60 L/min through the breathing system.

(A) inspiratory resistance: less than 0.6 kPa (6 cmH_2O)

(B) inspiratory resistance: less than 0.45 kPa (4.5 cmH_2O)

SPECIFICATION

4.3 Internal Compressible Volume

Note that the reservoir bag is not fitted and the bag mount blocked.

These figures are measured with:

(A) **An absorber fitted with 1060 mm (42 inch) breathing hoses complying with ISO 5367, and a Penlon Safelock Y-piece.**

Volume required to raise the system pressure to 3 kPa (30 cmH_2O) = 180 ml

(B) **Absorber only.**

Volume required to raise the system pressure to 3 kPa (30 cmH_2O) = 170 ml

Other disposable breathing hoses may give different figures; the supplier of the hose will provide compressible volume figures.

4.4 System Leakage Rate

The patient connection port is sealed and the APL valve fully closed.

These figures are measured with:

(A) **An absorber fitted with 1060 mm (42 inch) breathing hoses complying with ISO 5367, and a Penlon Safelock Y-piece.**

Absorber 'ON'

Leakage rate: less than 50 ml/min at 3 kPa (30 cmH_2O)

(B) **Absorber only.**

Absorber 'OFF', canister removed.

Leakage rate: less than 50 ml/min at 3 kPa (30 cmH_2O)

4.5 Canister Capacity and Resistance

4.5.1 Canister Capacity

When filled to the MAX level mark, the canister holds 1.3 kg (2.87 lb) of absorbent (1500 ml).

Recommended absorbent:
Soda lime or barium lime, with a colour indicator, 4-8 mesh, supplied in bulk.

Alternatively, pre-packs may be used.

Note
i) The absorber canister is not electrically conductive.
ii) Cleaning and sterilisation details are given in section 7.

4.5.2 Canister Resistance

The resistance of a freshly filled canister is less than 0.2 kPa (2 cmH_2O) at 60 L/min.

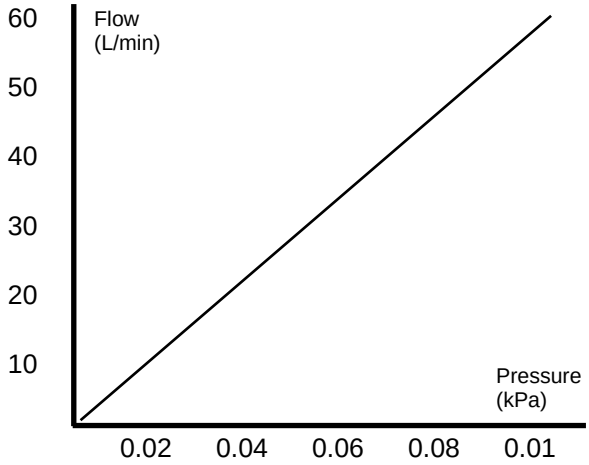
SPECIFICATION

4.6 Non-return Valves

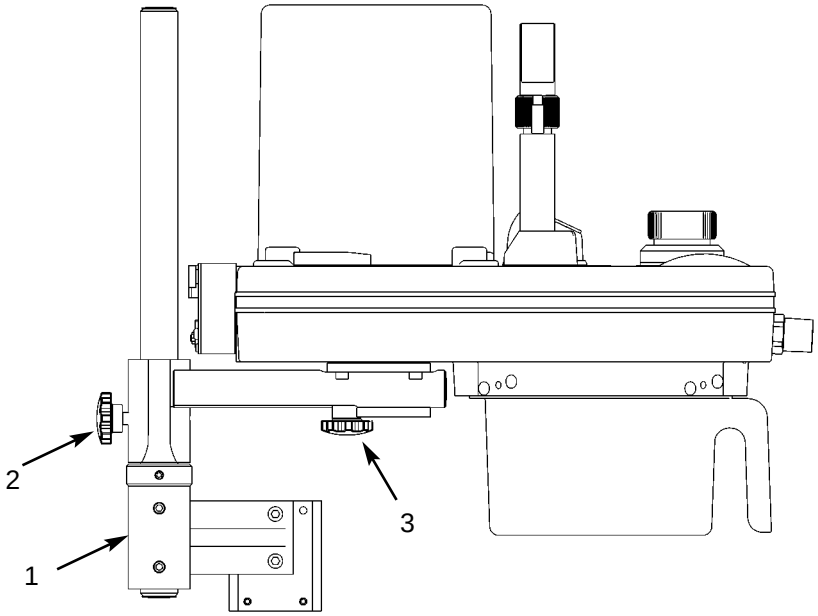
Pressure drop across the inspiratory and expiratory non-return valves at an air flow of 60 L/min: 0.1 kPa (1 cmH_2O).

Note that flow characteristics are identical for valves in a dry or wet condition.

A 'wet' valve is defined as a valve in a flow of humidified gas, such that moisture is visible on the surface of the valve.



5. INSTALLATION AND OPERATION



5.1 Mounting the Absorber

CAUTION

If the absorber has to be lifted or carried by hand, always support the weight of the unit under the base.

Do not lift the absorber by gripping any of the components attached to the manifold block at the top of the absorber.

WARNING

The absorber assembly must only be used when securely mounted in an upright position.

a) Non-return valves are gravity operated

b) Spillage of absorbent may contaminate the breathing system.

Polemount bracket assembly (1)

Secure the polemount assembly to the side of the anaesthetic machine.

Mount the absorber on the bracket assembly, and secure by tightening the knob (2)

Height Adjustment

Slacken the knob (2) and position the assembly at the required height.

Tighten the knob.

Lateral Adjustment

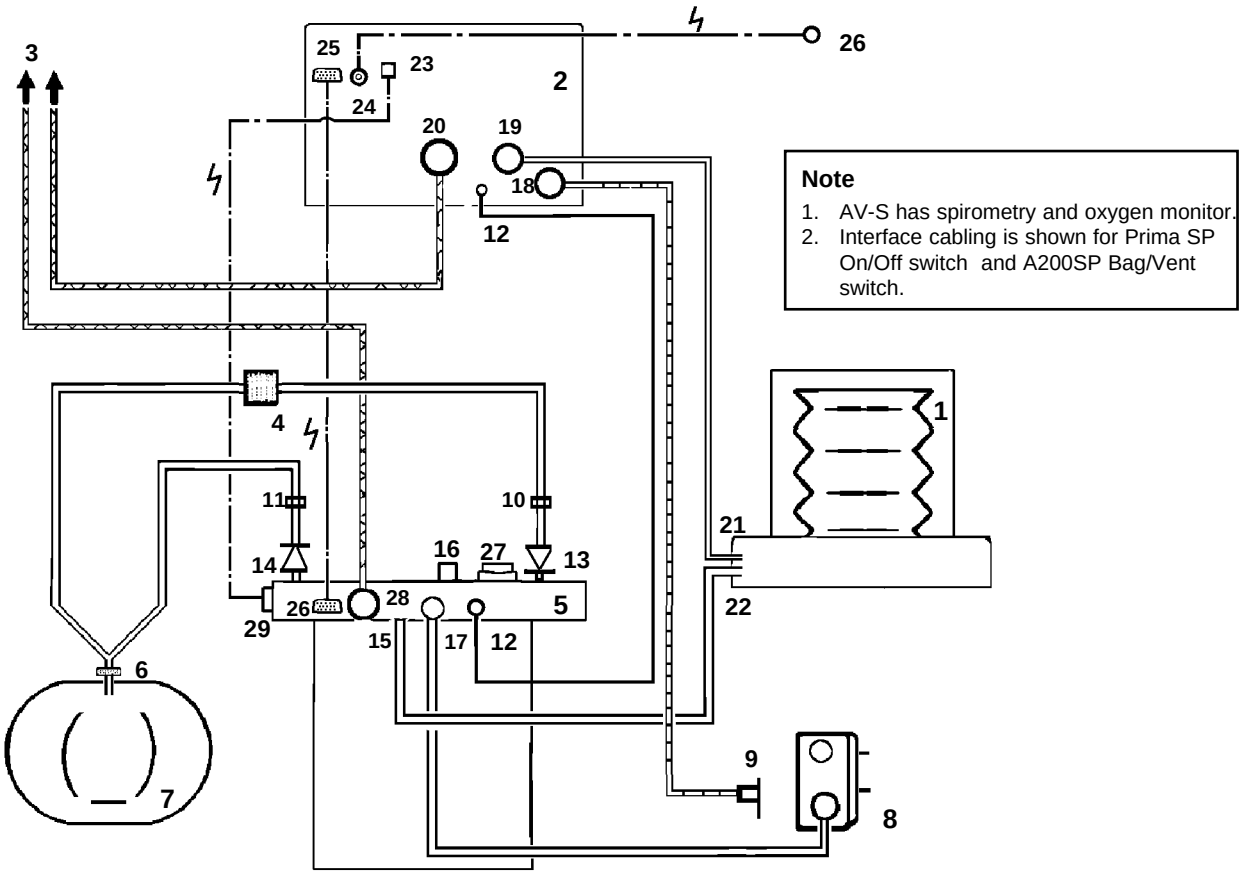
Slacken the knob (3) and carefully adjust to the required position.

Tighten the knob.

INSTALLATION AND OPERATION

5.2 System Connection

Hoses and Cables Schematic
AV-S and A200SP Absorber



1. Bellows
2. Ventilator Control Unit
3. Outlets to Anaesthetic Gas Scavenging System (AGSS)
4. Bacterial Filter
5. Absorber valve block
6. Heat and moisture exchanger
7. Patient
8. CGO Block on anaesthetic machine (Fresh Gas Supply)
9. Auxiliary Outlet on anaesthetic machine (Drive Gas Supply)
10. Flow sensor - expiratory
11. Flow sensor - inspiratory
12 Connectors - sensor - pressure monitor
13. Expiratory Valve - Absorber
14. Inspiratory Valve - Absorber
15. Inlet - from Ventilator Bellows
16. Connector - Reservoir Bag
17. Inlet - Absorber - Fresh Gas Supply
18. Drive Gas Inlet - Ventilator
19. Drive gas Outlet - ventilator control unit to bellows
20. Outlet - Exhaust Valve
21. Inlet - Bellows Drive Gas
22. Outlet - to breathing system
23. Input socket - Oxygen monitor sensor
24. Input socket - Prima SP interface (SP on/off switch)
25. Input socket:
    (i) A200SP Absorber Bag/Vent control position
    (ii) Spirometer sensor signal
26. Interface connections on Prima SP and A200SP
27. APL Valve
28 Outlet from APL Valve to AGSS
29 Oxygen sensor

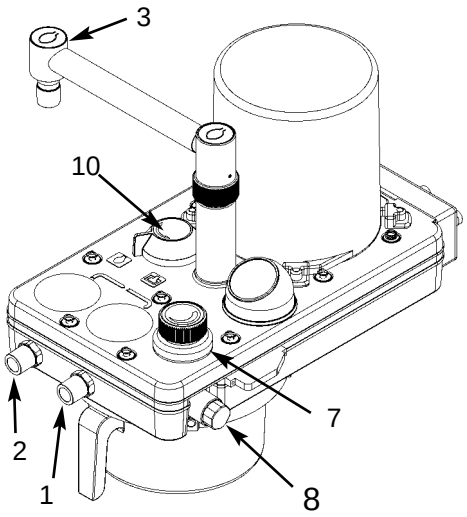
INSTALLATION AND OPERATION

5.2.1 Breathing System Hose, Reservoir Bag, Ventilator

Inspiratory (1) and expiratory (2) hose connectors and the reservoir bag connector (C) are 22 mm male, complying with ISO 5356/1.

The bag arm (3) is height adjustable, and the bag connector can be rotated to the desired position

Ventilator connection point (4)
Connect a 16 mm diameter corrugated hose between the ventilator control unit drive gas outlet (labelled: DRIVE GAS) and the connector (4) at the rear of the absorber.



5.2.2 Fresh Gas Supply

The fresh gas hose from the common gas outlet of the anaesthetic machine.assembly is connected at (5).

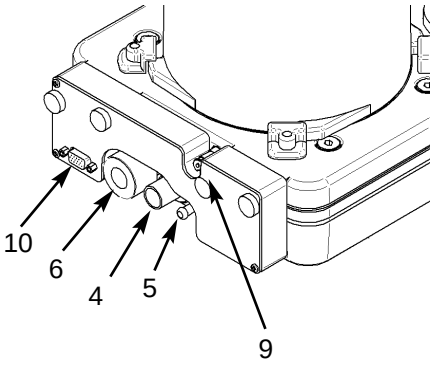
5.2.3 Anaesthetic Gas Scavenging (AGS)

The outlet (6) from the APL valve (7) must be connected to a receiver system.

WARNING

Do not connect a vacuum system directly to the APL valve. A receiving system with a positive and negative pressure control function must be interposed.

The system must comply with the requirements of ISO 8835 part 2.



5.2.4 Oxygen Monitor

The use of an oxygen monitor (and a carbon dioxide analyser) is highly recommended when using any partial rebreathing anaesthetic system.

Oxygen Monitor - the sensor (8) is fitted to the right hand side of the absorber.

Bacterial Filter
Use a breathing system bacterial filter in the expiratory limb of the breathing circuit to protect the oxygen sensor (see section 5 in the AV-S ventilator user manual).

CAUTION
Replacement/Disposal - always follow the instructions supplied with the filter, and always replace at the recommended interval.

5.2.5 Pressure Monitor and Spirometer

Pressure monitor self-sealing connector (9).
Connect to PATIENT PRESSURE port on the rear panel of the AV-S ventilator control unit.

5.2.6 Bag/Vent Switch and Spirometer

The multifunction connector (10) provides an interface between the AV-S ventilator and
(a) the spirometer flow sensors, and
(b) the sensor that detects the position of the Bag/Ventilator switch (11) .

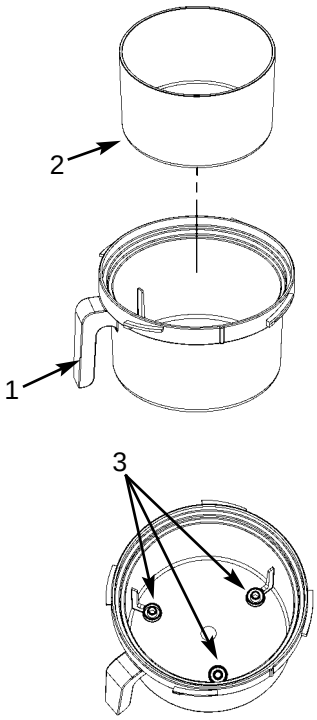
INSTALLATION AND OPERATION

5.3 Changing CO_2 Absorbent

WARNING
If the absorbent is to be changed during clinical use, adequate fresh gas flow must be maintained to prevent excessive build up of CO2.

Removing the canister

WARNING
Condensation, which may collect in the bottom of the absorber canister, is caustic. Avoid skin contact when draining.



1. Grip the handle (1), turn the canister anti-clockwise, and remove carefully.
2. Check the level of liquid in the canister.
   Carefully lift out the inner absorbent container (2).
   WARNING
   Condensate may drip from the container.
   Use a cloth to prevent spillage.
3. Dilute the liquid in the canister with water before disposal. Follow your hospital procedure.
4. Dispose of the absorbent from the inner container.

Cleaning

Soda lime tends to adhere strongly to surfaces when it has become exhausted.

To maintain good sealing, the canister, absorbent container, seal, and the sealing plate above the canister should be wiped with a damp cloth to remove particles of soda lime, whenever the absorbent is changed.

Refilling with absorbent

WARNING
Underfilling can lead to inefficient CO2 absorbtion. Overfilling may result in poor sealing of the canister due to caking of granules and abrasion of the canister seal.

1. Pre-packed soda lime:

   Remove the packing seal, following the manufacturer's instructions.

(a) Check that the container (2) is clean and dry and empty of dust or soda lime granules

(b) Insert the pre-pack into the container. Follow the instructions provided by the pre-pack manufacturer.

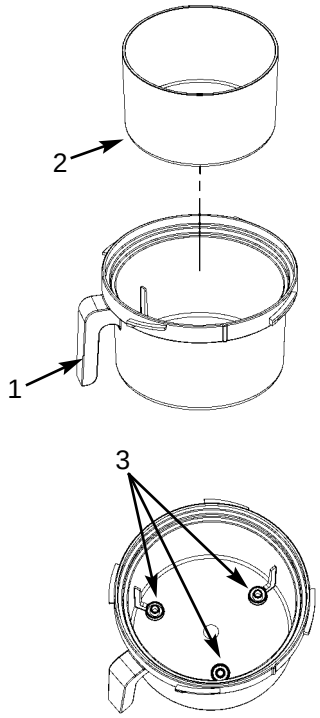
2. Using bulk packed soda lime, check the container in the same manner, then place it on a horizontal surface and fill it with soda lime up to the MAX line, but not above it.

Refitting the canister

1. Check that the three spacers (3) are in place, refit the container (2) to the canister (1), then refit the canister.

   Check that the seal and the canister align correctly as the canister is rotated clockwise to the locked position.

2. Leak test the absorber – see section 6.2.



5.4 Manometer

The manometer is located on the top of the manifold block, to the rear of the inspiratory valve. If the manometer has been removed and refitted, Function test the absorber, checking for leaks at the manometer, before clinical use.

CAUTION

Remove the manometer before autoclaving the absorber unit.

6. PRE-USE CHECKS

6.1 Pre-use Checklist

1. Check the absorbent, replace if necessary.

   Before refitting the canister, check that the sealing surfaces are clean and dust free. Ensure that the canister in place when refitted.

2. Check that the fresh gas hose is connected to the anaesthetic machine.

   Note that the anaesthetic machine must be leak tested before the absorber pre-use checks are made.

3. Leak test the absorber – see section 6.2

4. Carry out a function check and pressure relief test on the APL valve – see section 6.3.

5. Check the inspiratory and expiratory non-return valves for correct operation – see section 6.4.

6. Check the Bag/Ventilator switch for correct operation – see section 6.5.

7. Carry out a leak test with the canister removed - see 6.6

8. Repeat the absorber leak test – see section 6.2.

PRE-USE CHECKS

The procedures detailed in sections 6.2 to 6.6 must be carried out in the order listed.

The absorber must be attached to an anaesthetic machine, which must be leak tested before the checks are carried out.

Check that the manometer is zeroed before use.

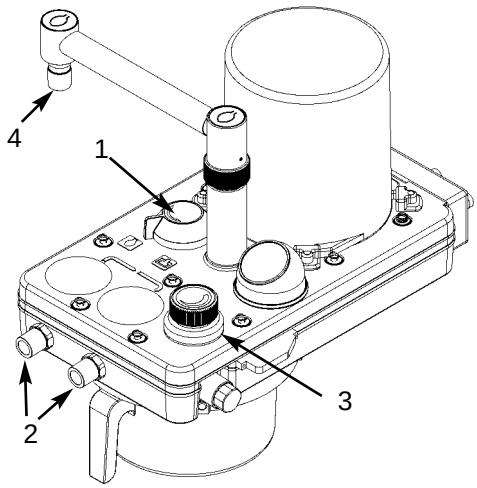
6.2 Leak Test

Check that the bag is correctly fitted, and set the switch (1) to 'Bag'.

Connect the fresh gas hose to the anaesthetic machine.

Use a breathing system hose to connect the patient ports (2) to form a closed, leak-free circuit.

Close the APL valve (3).



1. Turn on a flow of 2 L/min of oxygen and pressurise the system.
2. Stop the gas flow when the system pressure reaches 3 kPa (30 cmH_2O) and check that pressure is maintained, i.e. the pressure must not fall to zero in less than one minute.

6.3 APL Valve Test and Pressure Relief Test

APL Valve Function

1. Open the APL valve (3).

   Check that gas escapes freely from the system through the valve outlet.

APL Valve Flow Resistance

2. Set maximum flow and check that the retained pressure is less than 0.5 kPa (5 cmH_2O).
3. Reduce flow to minimum.

Pressure Relief

4. Close the APL valve fully (clockwise).
5. Remove the reservoir bag and block the bag port (4).

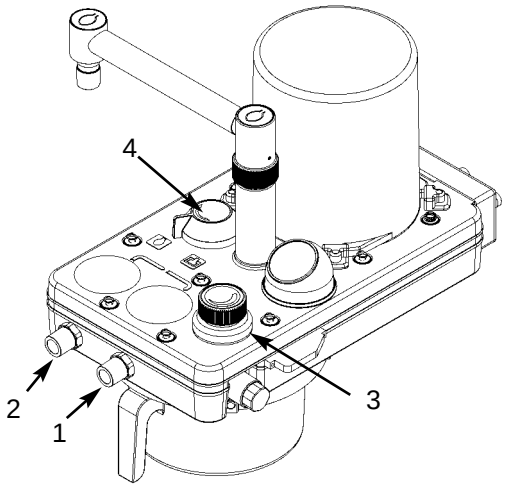
   Use the flow controls on the anaesthesia machine to produce a high flow of gas into the system and check that the APL valve provides excess pressure relief.

   The manometer reading must not exceed 6 kPa (60 cmH_2O) ± 10% at 6 L/min.

   Refit the reservoir bag.

PRE-USE CHECKS

6.4 Inspiratory and Expiratory Non-return Valve Test



1. Detach the hose connecting the inspiratory (1) and expiratory (2) connectors.
2. Check that the APL valve (3) is closed.
3. Block the inspiratory valve outlet (1) with a suitable bung, and inflate the reservoir bag with a 2 L/min oxygen flow.
4. Turn off the gas flow and check that the bag does not empty by reverse flow through the expiratory valve (2).
5. Remove the bung and attach a spare reservoir bag to the inspiratory valve connector (1).
6. Turn on a 2 L/min oxygen flow and fully inflate this bag (and the absorber reservoir bag).
7. Turn off the gas flow. Check that gas cannot be forced through the inspiratory valve by gentle squeezing of the spare bag on the valve outlet.
8. Remove the bag from the inspiratory connector (1).

6.5 Bag/Ventilator Switch

1. Refit the breathing hose between the inspiratory (1) and expiratory (2) connectors.
2. Set a flow of 10 L/min and check that bellows starts to inflate.
   Ensure that bag is not inflating.
3. Move switch (4) to Bag position and watch bag inflate and bellows stops rising.
   When the pressure reads 3 kPa (30 cmH_2O) turn off the flow of gas.
4. Select ventilator, pressure on gauge should drop, but bag should remain inflated.
5. Squeeze bag, there should be no loss of pressure, and bellows must not rise.

PRE-USE CHECKS

6.6 Leak test - Absorber Canister Removed

1. Remove absorbent canister (1).

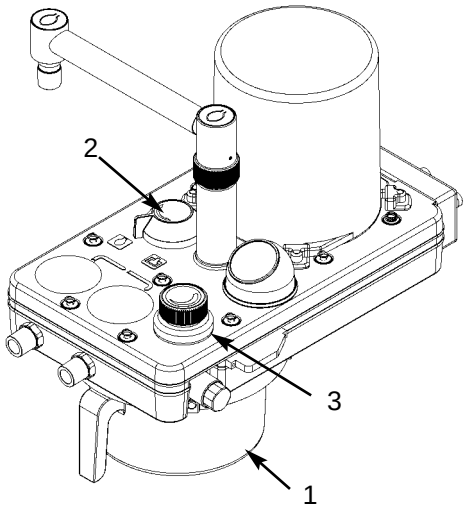
   Set the switch (2) to Bag position and close APL valve(3).

2. Pressurise the system to 3 kPa (30 cmH2O) and turn off the gas flow.
3. Check that pressure does not fall to zero within one minute.
4. Refit absorbent canister.

   A pressure loss will occur as valves operate.

   Repressurise the system to 3 kPa (30 cmH2O) and turn off gas flow.

5. Check that pressure does not fall to zero within one minute, then open APL valve to release pressure.



7. SERVICE PROCEDURES

7.1 Service Frequency

Servicing and repairs must only be carried out by Penlon-trained technicians and engineers.

(a) Six-monthly inspection and function testing.

(b) Annual and four-year service which includes routine replacement of seals etc., as preventive maintenance.

7.2 Canister and Seals

Cleanliness is the essential requirement for all components in contact with absorbent.

Soda lime tends to adhere strongly to surfaces when it has become exhausted.

To maintain good sealing, the canister, absorbent container, seal, and the sealing plate above the canister should be wiped with a damp cloth to remove particles of soda lime, whenever the absorbent is changed.

These components should be scrubbed under running water when the complete system is dismantled for sterilisation or disinfection.

See section 8.4.

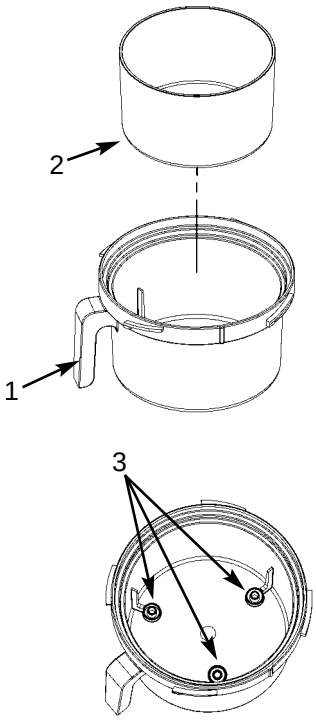
SERVICE PROCEDURES

7.3 Condensate Drainage

WARNING

Condensation, which may collect in the bottom of the absorber canister is caustic and care must be taken not to spill it on the skin when draining. Wear suitable protective gloves.

Dilute the liquid with water before disposal.



Daily Procedure:

1. Check the level of liquid in the canister (1). If necessary, remove the canister by turning anti-clockwise, and carefully lift out the inner absorbent container (2).
   WARNING
   Condensate may drip from the container. Use a cloth to prevent spillage.

2. Dilute the liquid in the canister with water before disposal. Follow your hospital procedure.

3. Refit the container, ensuring that the three spacers (3) are located as illustrated.

4. Refit the canister to the absorber.

7.4 Manometer

Remove the manometer before sterilisation or disinfection.

Grip the manometer and detach from the absorber.

CAUTION *Do not sterilise the manometer.*

7.5 APL Valve

Autoclave the valve as part of the absorber assembly - - see section 8.5. .
Check that the valve is in the open position before autoclaving.

Do NOT wash in an automatic cleaning/washing machine.

8. SERVICE SCHEDULE

1 Initial Checks

1.1 Check serial numbers to determine service required.
1.2 Check general condition of Absorber and fittings.
1.3 Quarter turn absorbent canister and remove.
Remove inner canister.
Drain any condensate from outer canister and re-fit:
Caution Caustic Solution
1.4 If component replacement is required, disconnect fittings at rear of absorber and remove absorber from anaesthesia machine.
Place absorber on flat work surface with absorbent canister removed

2 Bag arm assembly

2.1 Check bag arm assembly for movement and security of attachment
2.2 Unscrew Bag arm connector and replace O' Ring - 041217

3 Manometer

3.1 Grip manometer assembly and remove by pulling firmly upwards.
Remove manometer and ensure it indicates zero. If not adjust using small screw.
3.2 Using a hand-bulb and test manometer apply increasing pressure, up to 100 cmH2O and ensure manometer reads within +/- 5 cmH2O.
3.3 Replace manometer O-ring - 5000349

4 Bellows assembly

4.1 Remove bellows canister.
Examine bellows, diaphragm and canister seal for cleanliness and deterioration
4.2 Replace canister seal - 5000072
4.3 Replace bellows and diaphragm valve as part of ventilator service procedure

5 Electrical Interface Box

Disconnect electrical interface connector.
Undo the four thumbscrews securing electrical box to absorber and remove electrical box
Replace four O-rings - 041230

6 Internal component inspection and replacement (Upper)

Undo the eight ¼ turn Dzus fasteners and lift up Bellows Plate
Replace Bellows Plate gasket - 5000080
Replace Inspiratory and Expiratory Disc valves (x2) - 5000394

7 APL Valve

Unscrew APL valve retaining sleeve.
Remove valve plunger and replace APL valve seal - 5000364.
Re-fit plunger and retaining sleeve

8 Internal component inspection and replacement (Lower)

Lift away the Centre Plate
Replace the Base Plate gasket - 5000081
Replace the Bag/Ventilator switch o-rings (x2)- 5000202
Inspect by-pass valve seals for cleanliness and deterioration
Clean seals and re-grease valve stems
Replace absorbent canister gasket - 5000092

9 By-pass plate removal

Remove the 'E' clips securing the valve seals and supports and remove.
Remove further two 'E' clips from by-pass plate guides.

Lift Bellows Plate from the By-pass Plate
Replace large o-ring - 5000273, and small o-ring - 5000274
Replace valve seals (x3) - 5000097
Replace seal support internal o-rings (x3) - 5000135
Apply oxygen-safe grease to By-pass Plate guides.
Re-assemble

10 Re-assembly

Re-fit Base Plate gasket; Centre Plate; Bellows Plate gasket
When re-fitting Bellows Plate ensure Bag/Ventilator knob is aligned with quadrant shaft and switch 'Push-Pin' is engaged.
Secure Bellows Plate with eight Dzus fasteners
Re-fit Bag arm connector and tighten. Use small drop of Loctite 243
Re-fit manometer ensuring it securely snaps into place
Re-fit electrical box and connect interface cable
Re-fit bellows assembly and absorbent canister assembly

11 Set Up

11.1 Connect absorber to anaesthetic machine that has been checked for LEAKS.
Check that manometer reads zero.

12 Leak Test

12.1 Absorber canister fitted
12.2 Ensure bag fitted to bag port and Bag/Vent switch to 'Bag' position.
12.3 Connect patient ports with hose to form a closed circuit.
12.4 Close APL valve.
12.5 Set a flow of 2 l/min on the anaesthesia machine.
12.6 Stop the gas flow when Manometer reads 3 kPa (30 cm H2O).
Ensure pressure does not fall to zero within one minute.

13 APL Valve Test And Pressure Relief Test

13.1 Fully open APL valve
13.2 Set maximum flow rate.
Check that manometer indicates 5cm H2O or less.
13.3 Turn off gas supply
13.4 Close the APL valve Fully.
13.5 Use O2 flow and check APL valve relieves pressure at 6 kPa (60cm H2O) +/- 10 % at, 6-l/min flow rate.

14 Inspiratory and Expiratory Non-return Valve Test

14.1 Remove hose from patient ports.
14.2 Occlude Inspiratory port with suitable bung.
14.3 Fully close APL valve
14.4 Fit re-breathing bag to bag arm and inflate with O2 flush.
Ensure bag does not deflate within one minute.
14.5 Remove bung from inspiratory port.
Transfer re-breathing bag, from bag-arm to Inspiratory port.
Occlude bag-arm with suitable bung.
14.6 Inflate bag with 02 flush.
Remove occlusion from bag port.
Ensure rebreathing bag fitted to inspiratory port does not deflate within one minute.
14.7 Remove bag from inspiratory port
Refit bag to bag-arm.

SERVICE SCHEDULE

15 Bag / Ventilator Switch Test 2

15.1 Ensure ventilator bellows and bag-arm bag are deflated
15.2 Refit hose to patient ports.
15.3 Select bag/vent switch to 'vent' and ensure APL valve fully closed.
15.4 Set a flow of 10 l/min and check that bellows starts to inflate.
Ensure that bag is not inflating.
Move Bag/Vent switch to Bag position.
Observe bag inflate and bellows stops rising.
When the pressure reads 3 kPa (30 cm H2O) turn off the flow of gas.
Select ventilator.
Pressure on gauge should drop but bag should remain inflated.
Squeeze bag.
There should be no loss of pressure and bellows must not rise.

16 Absorber Bypass function

16.1 Remove absorbent canister.
Select Bag position and close APL valve
16.2 Pressurise the system to 3 kPa (30cm H2O).
Turn off gas flow.
16.3 Check that pressure does not fall to zero within one minute.
16.4 Re-fit absorbent canister.
A pressure loss will occur as valves operate.
Re-pressurise the system to 3 kPa (30 cmH2O).
Turn off gas flow.
16.5 Check that pressure does not fall to zero within one minute.
Open APL valve to release pressure.

17 Paperwork

17.1 Restore user settings.
17.2 Sign and date service card, indicate service 6, 12, or 60 month.
17.3 Attach service cards to equipment.
17.4 Remove all tools, test equipment
17.5 THINK, carry out visual checks.
17.6 Fill out service report.

NOTE

This checklist is prepared for use by Penlon-trained Service Engineers.

Other components may be replaced at the discretion of the Engineer if signs of wear are apparent.
If a replacement is necessary, inform the appropriate hospital engineer.

,

SERVICE SCHEDULE

9. PARTS LIST

A200SP Preventive Maintenance Kits

Annual Service Components

Manometer O-ring	5000349
Bag arm connector O-ring	041217
Electrical Box O-ring (x4)	041230
Disc valves (x2)	5000394
Bellows Plate gasket	5000080
Base Plate gasket	5000081
Canister gasket	5000092
Bag vent switch O-ring (x2)	5000202
Fresh gas hose (0.5 metres)	462631
Tie wrap (x2)	103612
Bellows Canister seal	5000072

4-year Service Components

Manometer O-ring	5000349
Bag arm connector O-ring	041217
Electrical Box O-ring (x4)	041230
Disk valves (x2)	5000394
Bellows Plate gasket	5000080
Base Plate gasket	5000081
Canister gasket	5000092
Bag vent switch O-ring (x2)	5000202
Fresh gas hose (0.5 metres)	462631
Tie wrap (x2)	103612
Bellows Canister seal	5000072
APL valve seal	5000364
By-pass seal (x3)	5000097
Seal support internal O-ring (x3)	5000135
Large canister plate O-ring	5000273
Small canister plate O-ring	5000274

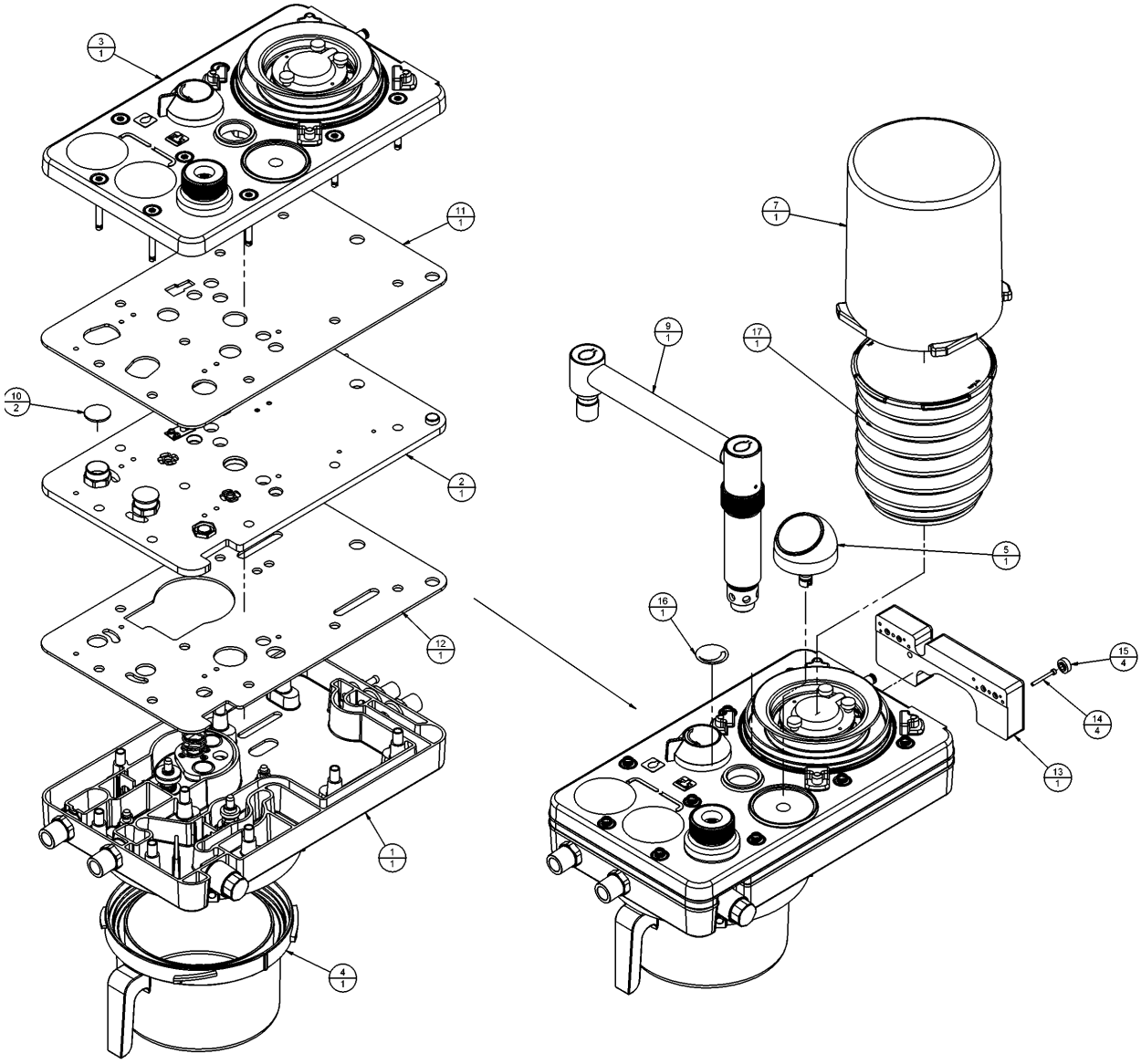
PARTS LIST

Major Assemblies and Miscellaneous Components

Item	Part No.	Description	Quantity
1	5000122	Base Plate Assembly	1
2	5000119	Centre Plate Assembly	1
3	5000118	Bellows Plate Assembly	1
4	5000120	Canister Assembly	1
5	5000121	Pressure Gauge Assembly	1
7	300049	Canister Screen Printed	1
9	5000117	Bag Arm Assembly	1
10	5000394	Valve Disc	2
11	5000080	Bellows Plate Gasket	1
12	5000081	Base Plate Gasket	1
13	5000320	Electrical Box Assembly	1
14	019075	Screw M3 X 30 Cap HD	4
15	011108	Cap (M3)	4
16	5000389	APL Valve Label	1
17	406027	Adult Bellows Assembly	1

NOTE
Components contained in assemblies 1 to 5, and 9 are shown in subsequent pages in this section

PARTS LIST

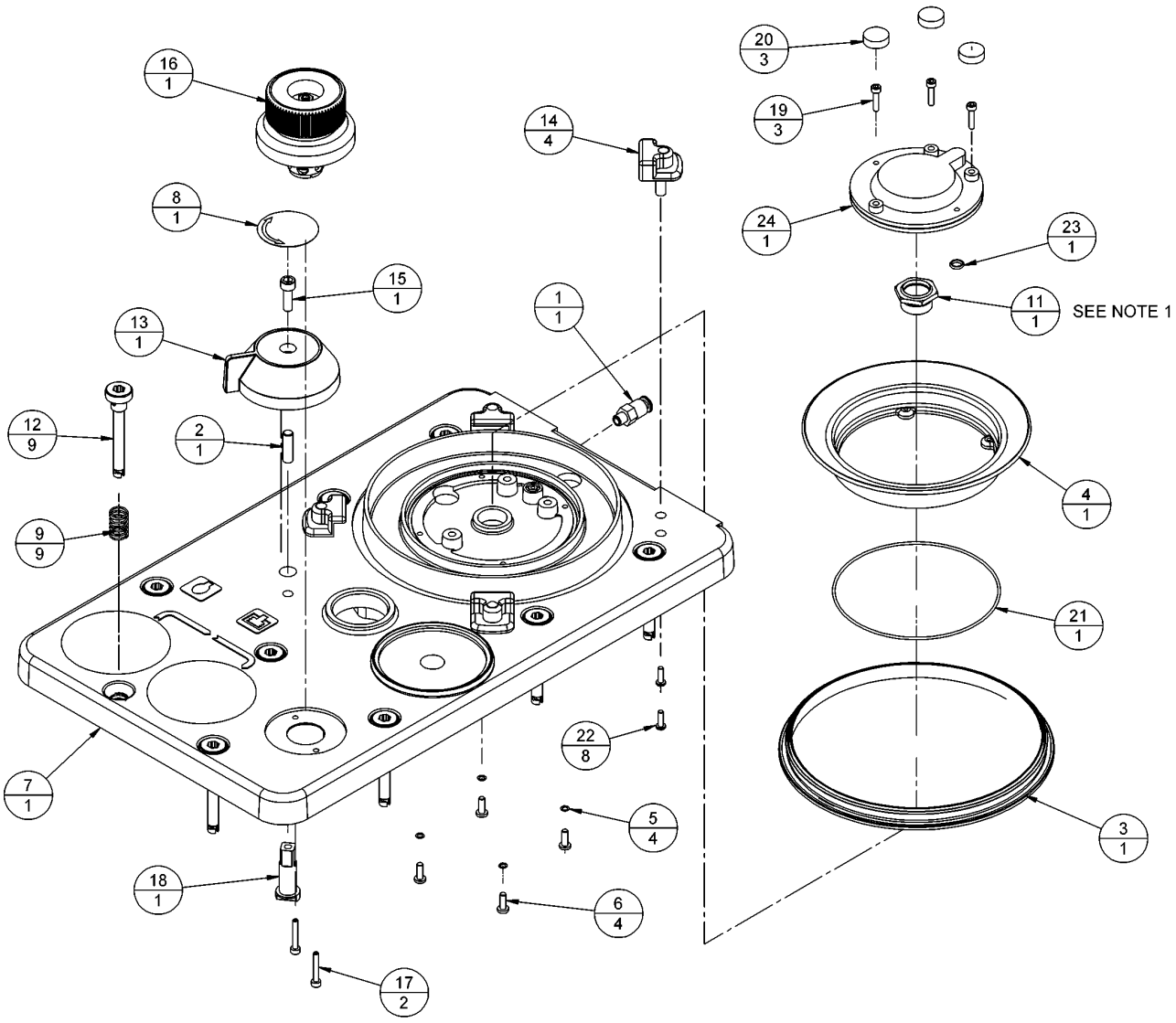


PARTS LIST

Bellows Plate and Top Cover Assembly

Item	Part No.	Description	Quantity
1	054529	Valve-One Way	1
2	5000071	Dowel Pin Ø6.0 X 20.0 Long ST STL	1
3	5000072	Bellows Canister Seal	1
4	5000495	Bellows Ring	1
5	025606	Washer M3 Fibre	4
6	020808	Screw No 6 X 3/8" Self Tap	4
7	5000116	Bellows Plate	1
8	5000393	Switch Knob Label	1
9	5000491	Compression Spring	9
10*	057003	Loctite 242	A/R
11	406059	Bellows Base - Seat	1
12	5000304	Stud Assembly	9
13	5000076	Switch Knob	1
14	406037	Bellows Location	4
15	01130	Screw M5 X 16 SKT Cap Head ST STL	1
16	5000123	APL Valve Assembly	1
17	019003	Screw M3 X 20 Ss SK HD	2
18	5000109	Switch Shaft	1
19	019110	Screw M3 X 14 Cap HD	3
20	011108	Cap M3	3
21	5000137	O Ring 94.0 I/D X 1.5 section Viton	1
22	020807	Screw No4 X 3/8" Self Tap	8
23	041204	Seal 5.1 I/D X 1.6 CSØ Viton	1
24	406020	Diaphragm Assembly	1

PARTS LIST


16 1
8 1
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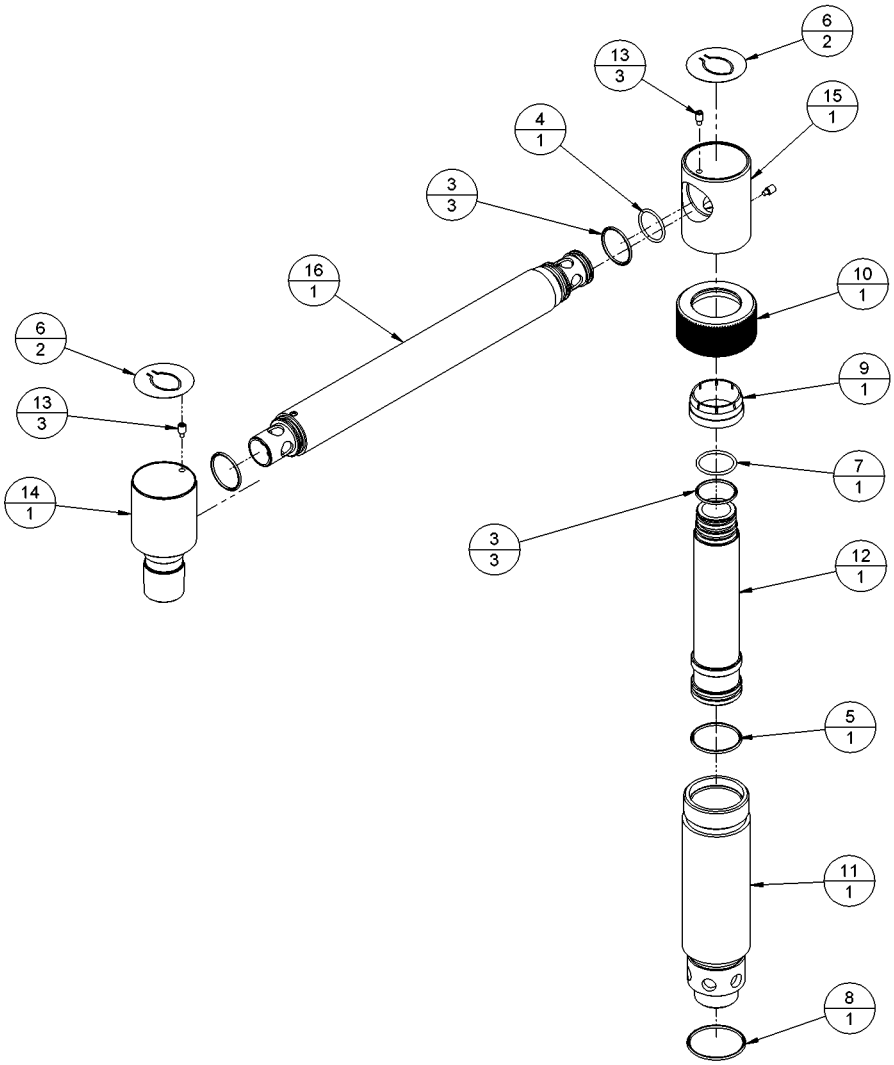
13 1
12 9
2 1
9 9
7 1
18 1
17 2
14 4
1 1
22 8
5 4
6 4
20 3
19 3
24 1
23 1
11 1
SEE NOTE 1
4 1
21 1
3 1

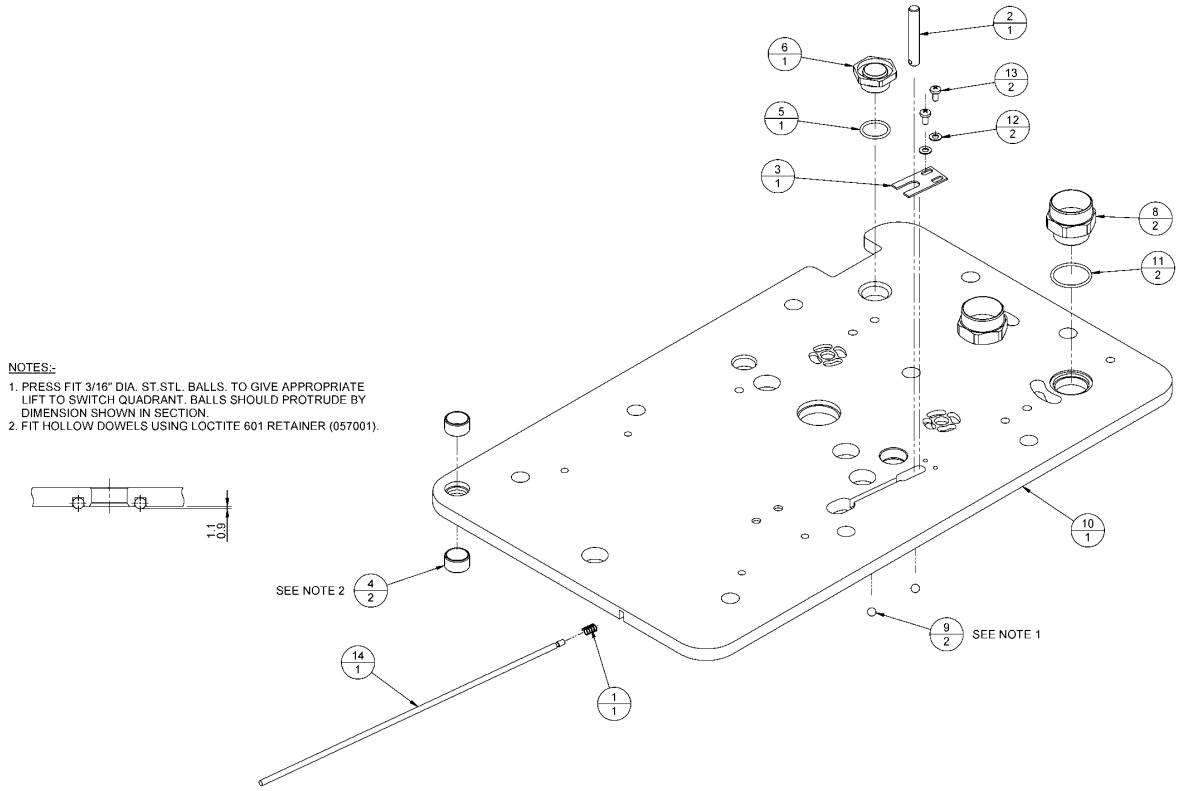
PARTS LIST



Bag Arm Assembly

Item	Part No.	Description	Quantity
1	029011	Molykote BG87	A/R
2	057003	Loctite 242	A/R
3	041231	O' Ring Ø 20.0 X 1.5 Cs	3
4	5000131	O Ring 17.0 I/D X 1.5 Section Viton	1
5	041207	O' Ring 0251-16	1
6	5000391	Label - Bag Arm	2
7	041212	'O' Ring Ø19.1 X Ø1.6 Viton	1
8	041217	O' Ring	1
9	5000085	Bag Arm Locking Ring	1
10	5000086	Bag Arm Locking Nut	1
11	5000087	Bag Arm Connector	1
12	5000084	Bag Arm Tube Inner	1
13	5000127	Screw M4 X 8 SKT Set	3
14	5000077	Bag End Adaptor	1
15	5000078	Bag Arm Swivel	1
16	5000079	Bag Arm	1

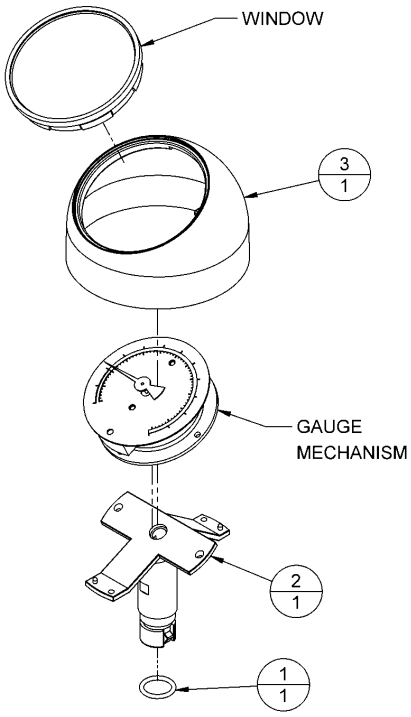
PARTS LIST

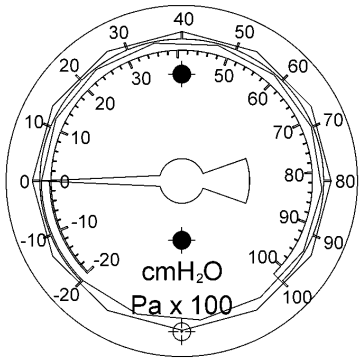

NOTES:-
1. PRESS FIT 3/16" DIA. ST.STL. BALLS. TO GIVE APPROPRIATE LIFT TO SWITCH QUADRANT. BALLS SHOULD PROTRUDE BY DIMENSION SHOWN IN SECTION.
2. FIT HOLLOW DOWELS USING LOCTITE 601 RETAINER (057001).
1.1
0.9
SEE NOTE 2
SEE NOTE 1

Centre Plate Assembly

Item	Part No.	Description	Quantity
1	031064	Spring Ø4.6 X 8.0LG	1
2	5000307	Push Pin	1
3	5000309	Push Rod Plate	1
4	5000075	Hollow Dowel	2
5	5000126	O-ring 14.0 I/D X 1.5 Section Viton	1
6	5000111	APL Valve Seat	1
7	057001	Loctite 601	A/R
8	5000115	Valve Seat	2
9	0462	Ø3/16 Ball SS	2
10	5000112	Centre Plate	1
11	041231	O' Ring Ø 20.0 X 1.5 CS	2
12	01067	Washer M3 Plain	2
13	01153	Screw M3 X 6 Pan HD	2
14	5000308	Push Rod	1

PARTS LIST

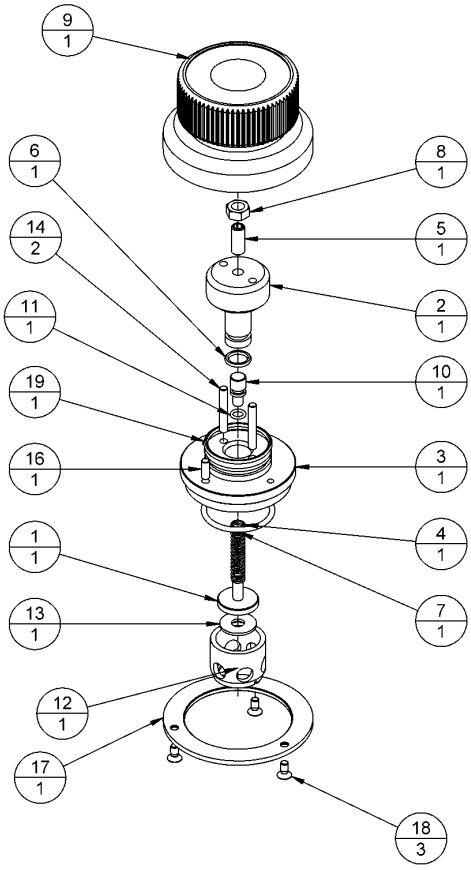




Manometer

Item	Part No.	Description	Quantity
	5000121	Manometer Assembly	1
		Includes:	
1	5000349	'O' Ring 10.0 I/D X 1.5 Section Viton	1
2	5000083	Gauge Connector	1
3	5000082	Gauge Cover	1

PARTS LIST



APL Valve

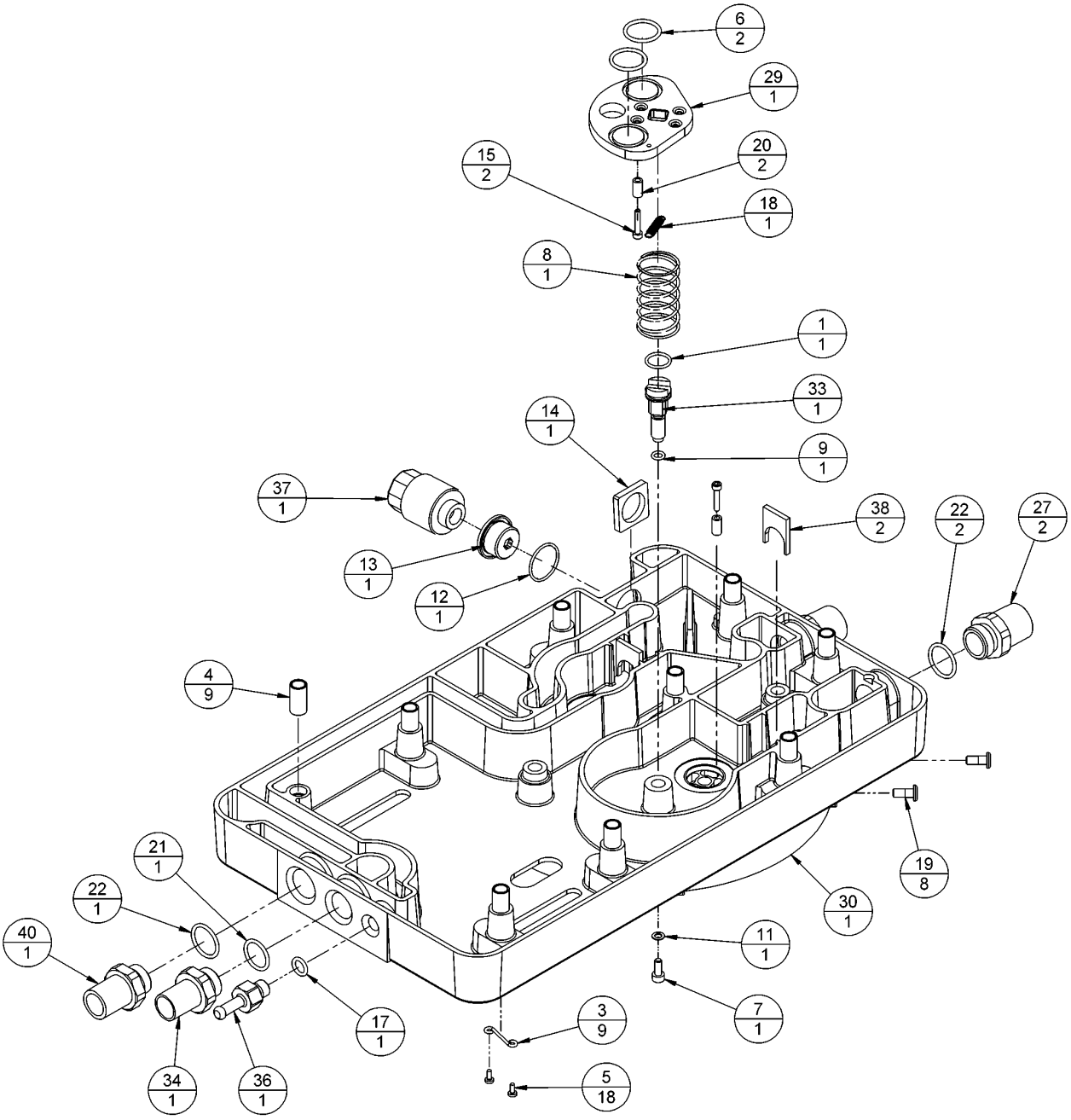
Item	Part No.	Description	Quantity
1	5000105	APL Valve Plunger	1
2	5000106	APL Valve Adjuster	1
3	5000107	APL Valve Body	1
4	5000125	Compression Spring	1
5	019074	M5 X 16 LG Set Screw Ss	1
6	041245	O Seal Ø7.0 X 1.5	1
7	5000128	O Ring 24.0 I/D X 2.0 Section Silicon	1
8	020001	M5 Nut	1
9	5000110	APL Valve Knob	1
10	5000108	Spring Location Bush	1
11	041256	O Ring	1
12*	5000363	Retaining Sleeve	1
13	5000364	Plunger Seal	1
14	020510	Dowel Pin Ø3 X 20	2
15*	029011	Molykote BG87	A/R
16	020533	Dowel Pin Ø3 X 8	1
17	5000468	Knob Location Plate	1
18	019117	M3 X 6LG CSK HD	3
19	041238	O' Ring Ø 23.0 X 1.5	1

PARTS LIST

Base Plate Assembly

Item	Part No.	Description	Quantity
1	041222	O' Ring	1
2	5000273	O Ring 59.5 I/D X 3.0 Section Silicon	1
3	5000442	Spring Clip	9
4	5000306	Location Dowel	9
5	01059	M2.5 X 6 Ch HD	18
6	5000202	O Ring 18.0 I/D X 2.0 Section Silicon	2
7	01013	M4 X 10 SKT HD Cap	1
8	5000136	Compression Spring	1
9	5000143	O Ring 5.0 I/D X 1.5 Section Viton	1
10	5000274	O Ring 24.5 I/D X 3.0 Section Silicon	1
11	01011	M4 Plain Washer	1
12	041239	O Ring Ø21 X 1.5	1
13	5000345	Cell Location Spigot	1
14	5000346	Cell Location Plate	1
15	019087	M3 X 16 Cap HD Screw	2
16	029011	Molykote BG87	A/R
17	5000344	O Ring 8.0 I/D X 2.0 Section Viton	1
18	5000342	Extension Spring	1
19	5000358	Canister Location Pin	8
20	5000490	Spring Locating Spacer	2
21	5000343	O Ring 16.0 I/D X 2.0 Section Viton	1
22	5000129	O Ring 18.0 I/D X 2.0 Section Viton	3
23	019067	M4 X 12 SKT HD Cap	4
24	5000104	Valve Stem	2
25	020420	Circlip External Ø8mm Shaft	6
26	5000103	Seal Support Plate	3
27	5000102	22 mm Taper	2
28	5000134	Compression Spring	2
29	5000101	Switch Quadrant	1
30	5000100	Base Plate	1
31	5000135	O Ring 8.0 I/D X 1.5 Section Viton	3
32	5000099	Bypass Plate	1
33	5000098	Quadrant Shaft	1
34	5000096	17 mm Taper	1
35	5000093	Spring Location Spigot	1
36	5000094	Fresh Gas Connector	1
37	102714	O2 Fuelcell	1
38	5000095	Orifice Plate	2
39	041256	O Ring	1
40	5000388	19 mm Taper	1
41	5000097	Valve Seal	3
42	5000092	Canister Seal	1
43	5000089	Support Pin	2
44	031046	Spring 16.76 O/D X 16 LG	2

PARTS LIST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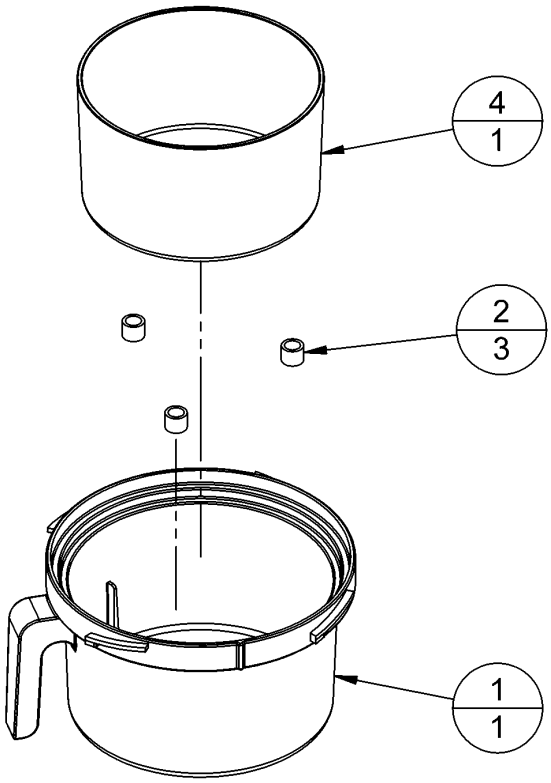
PARTS LIST



Canister Assembly

Item	Part No.	Description	Quantity
1	5000074	Canister Outer	1
2	5000396	Location Tube	3
3*	Sodalime	Pre-Pack	1
4	5000073	Canister Inner	1

**not shown*

10. APPENDIX

10.1 Sterilisation Policy

Follow your local hospital guidelines. Autoclavable components are listed in section 8.5.

10.2 Bacterial Filters

The use of respiratory bacterial filters is essential to protect the oxygen sensor mounted at the side of the side of the absorber.

Fit a bacterial filter to the expiratory limb of the breathing circuit.

In addition a heat and moisture exchange (HME) unit should be fitted at the patient Y-piece.

Refer to the diagram in section 5 – 'Breathing Circuit Connections', and the information on flow resistance in sections 4.2.1, and 4.2.2.

Filters may be sterilisable or single use. Please read the labelling supplied by the manufacturer.

CAUTION

Replacement/Disposal - always follow the instructions supplied with the filter or HME.
Always renew components at the recommended interval

NOTE

If a bacterial filter has not been used in the expiratory limb of the breathing circuit, the oxygen sensor may be contaminated and must be replaced.

10.3 Patient Circuit Components

The components should be separated, washed with warm soap and water solution, rinsed in warm water and air dried.

For sterilisation, follow the instructions supplied by the manufacturer.

STERILISATION

10.4 Absorber Assembly – Cleaning Procedure Before Sterilisation

WARNING

Condensation, which may collect in the bottom of the absorber canister is caustic and care must be taken not to spill it on the skin when draining.

CAUTION

When the absorber is lifted or carried by hand, always support the weight of the unit under the base.
Do not lift the absorber by gripping any of the components attached to the manifold block.

CAUTION

Do NOT clean any component in an automatic cleaning/washing machine.

1. Remove the canister (1), by turning anti-clockwise.

2. Carefully lift out the inner container (2) and dispose of the absorbent.
   WARNING
   Condensate may drip from the container.
   Use a cloth to prevent spillage.

3. Dilute the liquid in the canister with water before disposal. Follow your hospital procedure.

4. Thoroughly scrub off all particles of absorbent from the canister, inner container, seal and sealing face of the

5. Refit the container to the canister, ensuring that the three spacers (3) are located as illustrated.

6. Remove the manometer (4)

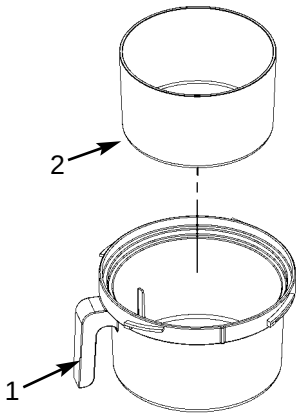
   Do not autoclave.

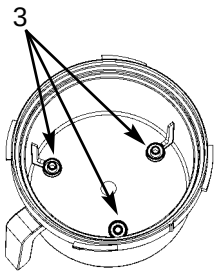
7. Remove the oxygen sensor (5) - disconnect the cable and unscrew the sensor from the side of the absorber

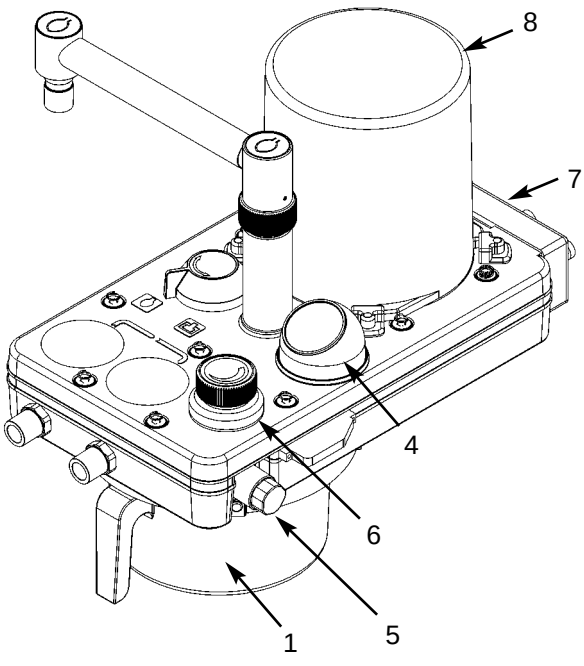
   Do not autoclave.

8. APL Valve (6) - autoclave the valve as part of the absorber assembly - check that the valve is in the open position before autoclaving.

9. Disconnect all connectors and hoses, then remove the electrical interface unit (7)



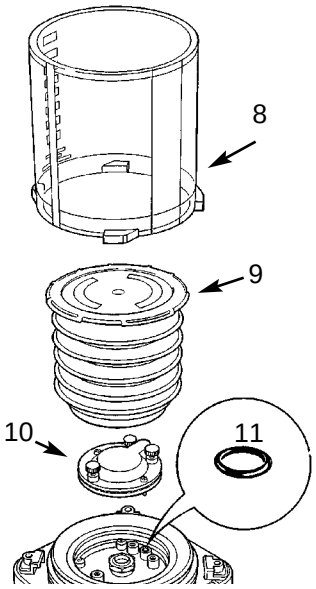




STERILISATION

Bellows Assembly

9. Turn the bellows housing (8) anti-clockwise, then lift it from the base.
   Remove the bellows (9).
10. Undo the three retaining screws, then remove the exhalation valve assembly (10).
    Check that the small O-ring (11) located in the bellows base under the diaphragm valve is in place. The ventilator will not function if the O-ring is missing.



Cleaning procedures before sterilisation

Absorber :

11. Remove the absorber assembly from the anaesthetic machine.
12. Wash the absorber assembly internally with warm water and soap solution, then rinse and air dry.
13. The absorber assembly can now be autoclaved as a single unit.

Ventilator Bellows Assembly:

Refer to section 7.2 in the AV-S user manual

STERILISATION

10.5 Sterilisation and Disinfectant Treatment Table

Component	*Soap water*	*Cidex Sonacid (Note 1)*	*Steam Autoclave*	*Maximum Temperature* ^{o}F	^{o}C
Breathing hoses (Penlon)	yes	yes	yes	278	137
Safelock fittings	yes	yes	yes	278	137
Reservoir bag (Penlon)	yes	yes	yes	278	137
Manifold block (including non-return valves)	yes	yes	yes	278	137
Frame assembly	yes	yes	yes	278	137
Canisters	yes	yes	no	–	–
APL valve	yes	yes	yes	278	137
Pressure gauge	no	no	no	–	–
PEEP valve	yes	yes	yes	278	137

AV-S Bellows Assembly - see section 6.3 in the AV-S user manual

General Notes:

1. Thorough rinsing in warm water and drying in air should follow chemical disinfection.
2. Do NOT clean any component in an automatic cleaning/washing machine.
3. Before clinical use, ALWAYS carry out the Pre-use Checks listed in section 6 of this manual.

InterMed Penlon

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